

Phys 4406	ADVANCED SOLID STATE PHYSICS	(CR3)
Preq.	Phys 3402/ ADP (Physics)	

Objectives

This course will provide an introduction to magnetic phenomena in solids.

Syllabus

Ferromagnetism and Antiferromagnetism: Ferromagnetic order, Curie point and the exchange integral, temperature dependence of the saturation magnetization, saturation magnetization at absolute zero, magnons, ferromagnetic magnons, quantization of spin waves, thermal excitation of magnons, neutron magnetic scattering, ferromagnetic order, Curie temperature and susceptibility of ferrimagnets, antiferromagnetic order, susceptibility below Neel temperature, antiferromagnetic magnons, ferromagnetic domains, anisotropy energies, transition region between magnetic domains, origin of domains, hysteresis curve, single domain particles, superparamagnetism, magnetic force microscopy. Magnetic resonance: Magnetic resonance phenomenon's in magnetism, nuclear magnetic resonance (NMR), equations of motion, line width, motional narrowing, hyperfine splitting, nuclear quadrupole resonance, ferromagnetic resonance (FMR), shape effects in FMR, spin wave resonance,



antiferromagnetic resonance, electron paramagnetic resonance, exchange narrowing, zero-field splitting.

Recommended Books

1. *Introduction to Solid State Physics* by C. Kittel, 8th Edition (2012).
2. *Magnetic Materials: Fundamentals and Applications* by N. A. Spaldin, 2nd Ed. (2011).
3. *Quantum Theory of the Solid State* by J. Callaway, 2nd Edition (1991).
4. *Introduction to Magnetic Materials* by B. D. Cullity & C.D. Graham, 2nd Ed. (2008).